



SPACE SHUTTLE PROGRAM
Shuttle Propulsion Office (MSFC)
NASA Marshall Space Flight Center, Huntsville, Alabama



PROGRAM ENVIRONMENTAL ASSURANCE

SHUTTLE ENVIRONMENTAL ASSURANCE AND THE FUTURE

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OVERVIEW

- SEA Team
- SEA Evolution
- Challenges to NASA Program
Environmental Assurance
- SEA Technical Issues
- Environmental Assurance
Implementation Challenges
- Successes
- Benefits
- Unfinished Business
- Lessons Learned
- SEA Future





SEA TEAM Overview

- Material availability continues to be impacted by domestic and international environmental health and safety (EH&S) regulations, industrial pollution prevention goals and related vendor economics
- SEA is an integrated team that works to identify, communicate and address safety and environmentally driven materials obsolescence issues and pollution prevention opportunities
 - Proactively identifies potential problems, makes efficient use of resources and expertise in mitigation
 - Uses a systems focus on issues driven by current or future EH&S drivers
 - Exercises a Risk Management Approach: evaluate program risk, mitigate, track, and control identified issues



SEA TEAM Structure

Management Team
Civil Service and Contractor

AFFECTED PROJECTS

Space Shuttle Program
Orbiter Project and Prime
ET Project and Prime
RSRB Project and Primes
SSME Project and Prime
Ground Operations and Prime
Flight Crew Equipment and Prime
Safety & Mission Assurance

INTERFACES

HQ Environmental Office
RRAC
TEERM

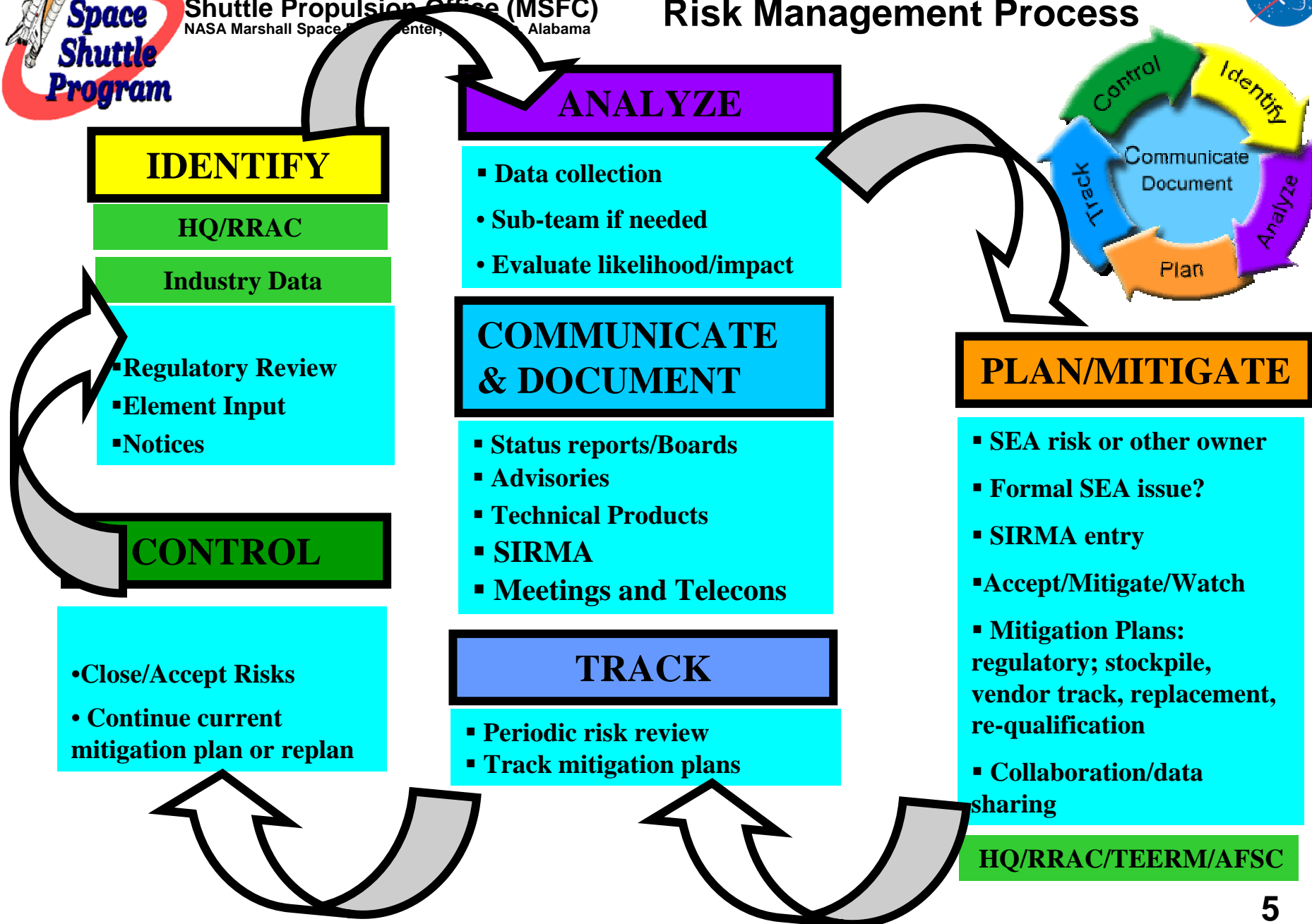
**Center Environmental
Management Offices**

Center Engineering Materials

**Air Force Space Command
Army Redstone
Others**

**Tri-Program Supportability
Council**

CxP/ISS

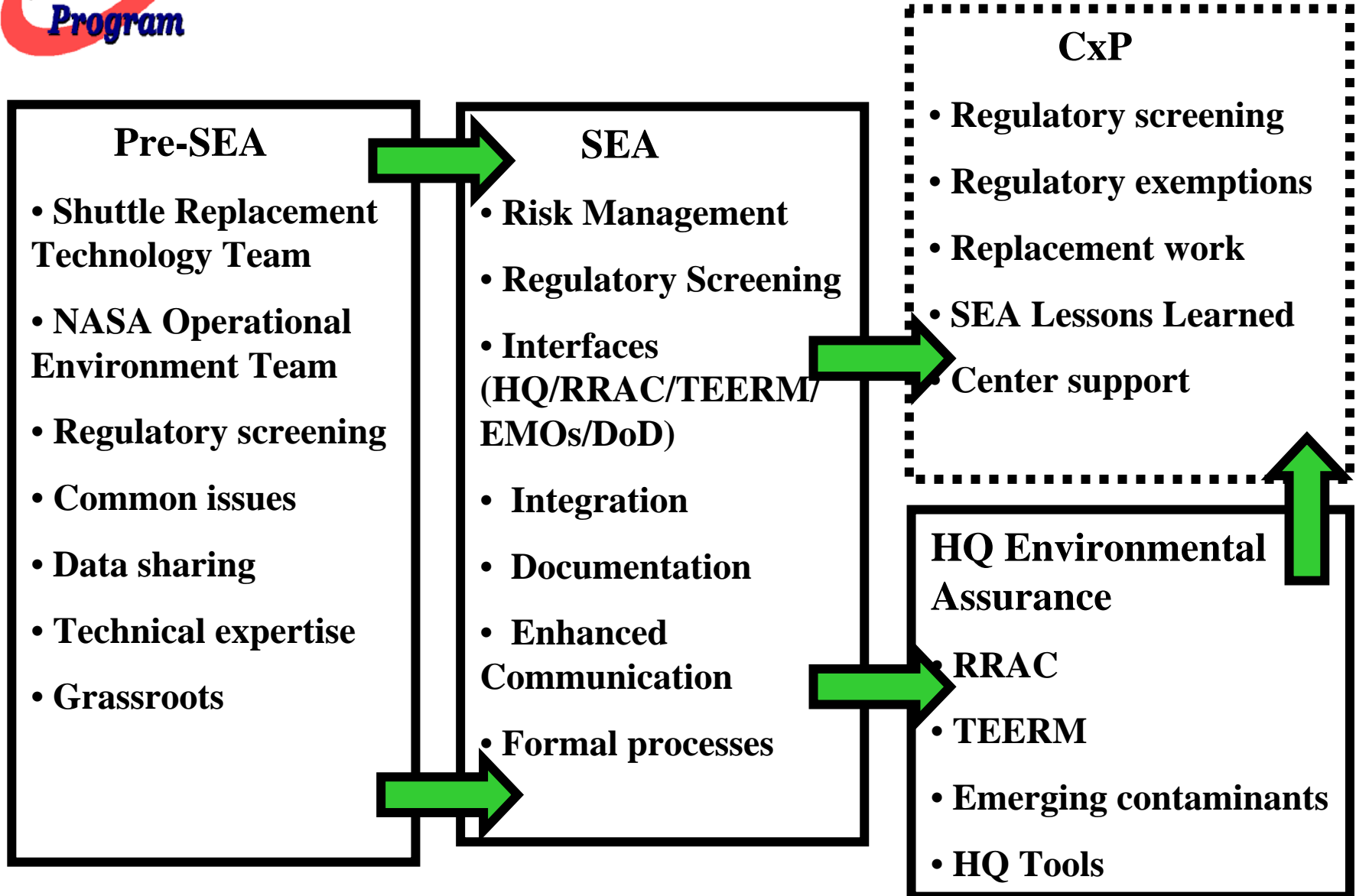




	SIRMA #	SSP 12/06 L x C	SSP 4/07 L x C	SSP 12/07 L x C	SSP 4/08 L x C
1,1,1 Trichloroethane Elimination (Orbiter use)	1018	2 x 5	3 x 4	3 x 4	3 x 4
1,1,1 Trichloroethane Elimination (RSRM use)	1019	2 x 5	1 x 5	1 x 5	1 x 5
Cadmium Replacement in Plating Applications	1020	3 x 4	2 x 3	2 x 3	2 x 3
Hexavalent Chromium Replacement in Primers	1021	3 x 4	2 x 4	2 x 4	2 x 4
Hexavalent Chromium Replacement in Conversion Coatings	1022	3 x 4	2 x 4	3 x 4	3 x 4
Chemical Paint Stripper Alternatives	1023	2 x 3	2 x 3	2 x 3	2 x 3
Alternate Dry-Film Lubricant	1024	2 x 3	2 x 3	CLOSED	CLOSED
High Volatile Organic Compound Coatings	1025	3 x 3	2 x 3	2 x 3	1 x 3
Hypalon Paint	1026	2 x 2	2 x 2	2 x 2	2 x 2
Lead-Free Electronics	1027	3 x 4	4 x 2	4 x 2	4 x 2
Hexavalent Chromium in Alkaline Cleaners	1028	2 x 3	2 x 3	2 x 3	CLOSED
Hazardous Air Pollutant Inks	1029	2 x 3	2 x 3	2 x 3	1 x 3
Methyl Ethyl Ketone	1030	CLOSED	CLOSED	CLOSED	CLOSED
Precision Cleaning and Verification Solvents	1031	2 x 3	2 x 3	CLOSED	CLOSED
Perfluoroalkyl Sulfonates	1032	3 x 2	3 x 2	CLOSED	CLOSED
Brominated Flame Retardants	1033		2 x 4	2 x 4	2 x 4
HCFC 141b Blowing Agent	2162	2 x 5	2 x 5	2 x 5	2 x 5
PFOA perfluorooctanoic acid	2823		2 x 5	2 x 5	2 x 5



SEA EVOLUTION





CHALLENGES TO NASA PROGRAM ENVIRONMENTAL ASSURANCE

- Increase in US and State regulations, complex environment
- Increase in EU regulation and potential for impact to vendors
- Direct impact of regulations on vendors and sub-tier suppliers
- Industry decisions to proactively replace hazardous materials even before regulation, sometimes with little or no notice
- Difficult to identify drivers and evaluate risk
- Change in assumptions and direction due to SSP 2010 retirement
- Supporting Missions: operational vs. development; SOMD vs. ESMD; multiple project life stages



ENVIRONMENTAL ASSURANCE IMPLEMENTATION CHALLENGES

- Confusion: environmental tasks, roles and responsibilities
 1. Environmental Assurance vs. Environmental compliance and NEPA
 2. Environmental Assurance Roles (Program/HQ/RRAC/TEERM/Centers)
 3. Materials vs. Environmentally driven materials obsolescence
- Confusion: SEA work/ownership of issues vs. SEA facilitated communication and discussion
- Many unique environmental assurance products
- Some difficulty getting contractors to share data, SSP elements report relevant work
- Sometimes team is out of the loop until something becomes an issue
- SSP focus is obsolescence – hard to justify Pollution Prevention work (depends on project life cycle)
- Difficulty in identifying if and where an at risk material is used in SSP
- Proactive identification of drivers is difficult (particularly industry drivers)
- Application of risk assessment scorecard and SIRMA process to multiple element, multiple impacts, multiple opinions, long term risk with high uncertainty
- Uncertainty concerning SEA future makes planning difficult



SUCCESES

- SEA Team: available expertise to address materials and environmental issues, provide technical feedback to SSP, CxP and HQ
- Face to face meetings: communication, data sharing, interfaces, team building
- Interfaces: HQ, RRAC, TEERM, EMOs, AFSC
- Communication: Notices, products, meetings
- Reporting: annual report, status report, monthly updates
- Risk Management approach: standard approach to risk assessment, SIRMA
- Success using technical sub-teams to address specific issues
- Success working with HQ on regulatory input and reviews
- Team is comfortable bringing up any issue; success in communicating to risk owners outside of SEA team
- SEA Issues
 - HFC 141b: reporting and coordination with HQ, RRAC, CxP, Primes
 - Lead free electronics: identified SSP risks, element specific mitigation strategies
 - PFOA: identified vendor-driven risk, sub-team working with industry to evaluate risk
 - Risks closed:
 - Alternate Dry Film Lubricant
 - Hexavalent Chromium in Alkaline Cleaners
 - Methyl Ethly Ketone
 - Precision Cleaning and Verification Solvents
 - Perfluoroalkyl Sulfonates



BENEFITS

SEA is reducing risk to the SSP associated with environmentally driven materials obsolescence by:

- Identifying regulatory impacts
- Working with regulators to minimize the adverse impact of regulatory restrictions
- Maintaining essential use exemption
- Providing notice and technical support concerning vendor changes and materials concerns
- Sharing material replacement data and working mitigation efforts
- Communicating potential issues and risks to management and other technical forums
- Interfacing with DoD and other agencies to share data/collaborate
- Identifying and mitigating environmental and material obsolescence concerns

Constellation, ISS and other Projects have benefited from established SEA activities

- HCFC 141b process and products greatly supported CxP exemption
- Regulatory matrix and review process in place
- Common issues and risk assessments
- Established team of expert contacts



UNFINISHED BUSINESS

- Major replacement work mostly terminated, stockpiling and vendor tracking instead
- Regulatory focus on near-term risks, no review of regulations with potential impact after 2010
- No regulatory mitigation planned past 2010
- Reduced resources, reduced reporting planned through 2010
- Expanding interfaces
- Major risk assessment process improvements



LESSONS LEARNED

- Effective program environmental assurance requires:
 - established requirements and management processes
 - management support and adequate resources
 - proactive, action orientation
 - committed and strong program, management, environmental, material, and regulatory team
 - ongoing documentation
- Effective approach includes:
 - systems focus and dedicated interdisciplinary team
 - risk management approach
 - proactive regulatory processes
 - effective communication and active interfaces
 - materials and environmental technical expertise
 - integrated technical and project management expertise



LESSONS LEARNED

- Multiple programs with interdependent and overlapping issues should coordinate to avoid mission impacts and ensure cost-effectiveness
- All stages of a project life cycle should consider environmental discipline, including design
- Programs should be encouraged to reduce environmental footprint
- SEA identified materials to avoid or address include:
 - HCFC 141b Blowing Agent
 - 1,1,1 Trichloroethane
 - Cadmium Replacement in Plating Applications
 - Hexavalent Chromium Replacement in Conversion Coatings and Primers
 - Lead-Free Electronics
 - Perfluoroalkyl Sulfonates/Perfluorooctanoic acid
 - Brominated Flame Retardants



SEA FUTURE

- SSP and CxP both carry risks related to loss of SEA capability
- Have had discussions with MSFC Engineering, RRAC, TEERM, HQ Environmental, CxP, SSP Propulsion Office, PSE&I, SSP Transition Team and CxP Transition Manager on need and approach to transition
- Also considered HQ or SOMD/ESMD-level team
- All agree on need for SEA like team to support CxP
- Provided PPBE input to CxP and Human Space Flight Capability exercise
- No current CxP or HQ funding support or commitment
- Current plan is to begin SEA termination along with SSP, provide data and information to CxP
- Draft SEA Transition and Retirement Plan under review



	SIRMA #	SSP 4/08 L x C	Potential CxP and/or ISS Risk
1,1,1 Trichloroethane Elimination (Orbiter use)	1018	3 x 4	NO
1,1,1 Trichloroethane Elimination (RSRM use)	1019	1 x 5	YES
Cadmium Replacement in Plating Applications	1020	2 x 3	YES
Hexavalent Chromium Replacement in Primers	1021	2 x 4	YES
Hexavalent Chromium Replacement in Conversion Coatings	1022	3 x 4	YES
Chemical Paint Stripper Alternatives	1023	2 x 3	YES
Alternate Dry-Film Lubricant	1024	CLOSED	NO
High Volatile Organic Compound Coatings	1025	1 x 3	YES
Hypalon Paint	1026	2 x 2	NO
Lead-Free Electronics	1027	4 x 2	YES
Hexavalent Chromium in Alkaline Cleaners	1028	CLOSED	YES
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STEPS TOWARD FUTURE SEA

Accomplished

- ✓ Draft SEA Transition Plan
- ✓ Begin development of SEA closeout technical documentation
- ✓ Include Ares, other CxP Projects and ISS in SEA telecons and meetings
- ✓ Share lessons learned with CxP and ISS
- ✓ Discussions with RRAC, and MSFC Engineering
- ✓ Regulatory Screening Matrix from RRAC
- ✓ Proposal and funding requirements provided to SSP, Human Space Flight and CxP management

Next Steps

- Identify responsible organization
- Obtain funding commitment and guidance from CxP or HQ
- Develop Management Plan
- Establish requirements
- Implement activity
 - Identify and begin to work shared issues and evaluate SSP replacement work for application to CxP
 - Review recent RRAC matrices for potential operational impacts
 - Identify issues and roadblocks and begin to address (e.g. allow SSP primes to support joint SSP/Cx work)
 - Clarify HQ involvement, potential to address other programs
 - Decide on organization where team management will reside
 - Identify contract mechanism for SEA support



SUMMARY

- SEA provides benefits to SSP
- CxP has a similar need, identified a risk
- SEA capability to be retired in 2010
- No CxP or HQ funding identified
- Suggestions?



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BACKUP



NOTIONAL TRANSITIONAL ENVIRONMENTAL ASSURANCE TEAM

Management Team
Civil Service and Contractor

AFFECTED PROJECTS

INTERFACES

SOMD/ESMD

Space Shuttle Program
Orbiter Project and Prime
ET Project and Prime
RSRB Project and Primes
SSME Project and Prime
Ground Operations and Prime
Flight Crew Equipment and Prime
Safety & Mission Assurance

Constellation
Ares I Upper Stage – Primes; Eng Teams
Ares I First Stage – Prime; Eng Teams
Ares I J2X – Prime; Eng Teams
Ares V – Prime; Eng Teams
Orion – Prime; Eng Teams

ISS

HQ Environmental Office
RRAC
TEERM

**Center Environmental
Management Offices**

Center Engineering Materials

**Air Force Space Command
Army Redstone
Others**

**Tri-Program Supportability
Council**



SSP ENVIRONMENTAL TASKS

NEPA (National Environmental Policy Act)	SSP (Glover)/ Centers/HQ
Environmental Compliance	Centers Primes SEA Team Interface
Environmental Remediation	Centers HQ Environmental SEA Team Interface
Environmental Assurance	
Identify Regulatory Changes/Negotiate with Regulatory Agencies	HQ Environmental/RRAC (Scroggins) SEA Team
Identify Industry/Market Changes	Logistics/Projects/Primes SEA Team
Program Level Environmental Assurance: Risk Management; Integration; Interfaces; Communication	SEA Lead (Glover) SEA Team
Identify/Evaluate Risks to Program and Projects	SEA Team Projects/Primes Engineering
Pollution Prevention	HQ Environmental/TEERM (Griffin) Centers SEA Team
Materials Replacement – Operations	Engineering M&P Projects/Primes SEA Team HQ Environmental/TEERM (Griffin)
Materials Replacement – Design/Testing	Engineering M&P Projects/Primes SEA Team HQ Environmental/TEERM (Griffin)